Biometric Technology in Rural Credit Markets: The Case of Malawi

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Identity theft is a common crime the world over. In developing countries, the damage caused by identity theft and identity fraud goes far beyond the individual victim, however, and ultimately creates a direct impediment to progress, particularly in credit markets. Recent research reveals that biometric technology can help reduce these problems.

A biometric is a measurement of physical or behavioral characteristics used to verify or analyze identity. Common biometrics include a person's fingerprints; face, iris, or retina patterns; speech; or handwritten signature. These are effective personal identifiers because they are unique and intrinsic to each person, so, unlike conventional identification methods (such as passport numbers or government-issued identification cards), they cannot be forgotten, lost, or stolen.

Recent advances in recognition technology coupled with increases in both digital storage capacity and computer processing speeds have made biometric technology (for example, ocular or fingerprint scanners) feasible in many applications, from controlling restricted building access to allowing more effective delivery of targeted government programs with large-scale identification systems, such as, for example, those being used in India.

Biometric technology can also improve access to credit and insurance markets, especially in countries that do not have a unique identification system, identity fraud—or, the use of someone else's identity or a fictitious one—to gain access to services otherwise unavailable to an individual is rather common. For example, lenders in Malawi describe past borrowers who purposefully defaulted then tried to obtain a fresh loan from the same or another institution under a false identity. And, although less common in developing countries because markets are less developed, the potential for sick individuals without healthcare coverage to use the insurance policy of a friend or relative does exist. The response of lenders and insurance companies has been to restrict the supply of such services to the detriment of many

creditworthy smallholder farmers who cannot finance crucial inputs such as fertilizer and improved seeds.

In the case of credit, biometric technology can make the idea of future credit denial more than an empty threat by making it easier for financial institutions to withhold new loans from past defaulters and reward responsible past borrowers with increased credit. As a result of this inability to "cheat the system," individuals may take out smaller loans that they are able to repay or avoid borrowing altogether if they cannot pay back any debt. Borrowers may have greater incentives to ensure that production is successful, either by exerting more effort or choosing less risky projects, and—whenever production could cover the loan repayment—borrowers may be less likely to default intentionally or opportunistically.

To look at the impact of biometric technology, Giné, Goldberg, and Yang (2009) implemented a field experiment using smallholder paprika farmers in Malawi. The authors collaborated with Cheetah Paprika Limited (CP) and the Malawi Rural Finance Corporation (MRFC). CP is a privately owned agri-business company that offers extension services and a package of seeds, pesticides and fungicides at subsidized rates in exchange for the commitment to sell the paprika crop to CP at harvest time. MRFC is a government-owned microfinance institution that provides financing for the in-kind loan package for up to one acre of paprika. The loan did not include cash to purchase inputs. Instead, borrowers took authorization from MRFC to a pre-approved supplier, which provided the inputs to the farmer and billed MRFC. The loan amount was roughly 17,000 Malawi Kwacha (approximately US$120). Sixty percent of the loan went towards fertilizer; the rest went toward the input package. While all who took the loan were given the package, farmers had the option to borrow only one of the two available bags of fertilizer. Expected yield for farmers using both bags of fertilizer on one acre of land was between 400-600kg, compared to 200kg with no inputs.

In the experiment, smallholder farmers organized in groups of 15-20 members applied for agricultural input loans to grow paprika and were randomly allocated to either a control or treatment group. The study sample covered four districts of the country and consisted of 249 clubs with approximately 3,500 farmers. In keeping with standard MRFC practices, farmers were expected to raise a 15% deposit, and were charged interest of 33% per year (or 30% for repeat borrowers).

After the baseline survey was administered to individual farmers, a training session was held for both the treatment and control clubs on the importance of credit history in ensuring future access to credit. Then, in treatment clubs only, fingerprints were collected as part of the loan application and an explanation was given that this would be used to determine their identity on any future loan applications. (Fingerprint recognition was used instead of face, iris, or retina recognition because the technology has been commercially available since the early 1970s, and

there is a highly competitive market for it. Therefore, it is inexpensive, well known, and widely used).

In the absence of fingerprinting, identification of farmers relies on the personal knowledge of loan officers. This institutional memory is lost if an officer is transferred, which happens often. Even when officers remain in a given location, the large number of borrowers can lead to mistakes in identification. MRFC's 120 credit officers handle upwards of 50,000 loans per year.

Although loan officers were told which clubs had been fingerprinted, they do not appear to have used this information in their loan approval decisions, nor have taken treatment status into account in their interactions with the clubs. This indicates that any impacts of the treatment should be interpreted as emerging solely from borrowers' responses to being fingerprinted.

The study shows that within the subgroup of farmers who had the highest ex ante default risk, fingerprinting led to increases in repayment rates of about 40 percent. By contrast, fingerprinting had no impact on repayment for farmers with low ex ante default risk. These higher repayment rates are due to fingerprinted borrowers requesting smaller loans amounts to ensure they would be able to repay them and devoting more land and inputs to paprika thus diverting fewer resources to other crops compared to their non-fingerprinted counterparts.

A rough cost-benefit analysis of the pilot experiment suggests that the benefits from improved repayment greatly outweigh the costs of biometric equipment and fingerprint collection, which accounts for basic training and the time it takes credit officers to collect biometric data. The benefit-cost ratio is an attractive 2.27. This benefit-cost calculation is likely to be quite conservative. The cost for equipment units could fall substantially if a fingerprinting function were integrated into equipment packages that had multiple functionalities, such as the hand-held computers that MRFC is considering for all of its loan officers. Transactions costs for fingerprint checking could fall due to volume discounts if the lending institution joined other lenders to channel all fingerprint identification through a single service provider.

There are other benefits to the lending institution that our benefit-cost calculation did not capture. The impact of fingerprinting on loan repayment may become larger over time as the lender's threat of enforcement becomes more credible. The benefits our study found were from fingerprinting *new* loan customers, but there also may be increases in repayment among existing customers who undergo fingerprinting. Finally, there may be welfare benefits that go beyond the profit of the lending institution, such as increased income for farmers due to more intensive input application.

Challenges in the implementation of biometric systems

Despite the encouraging results from the pilot in Malawi and the success of biometric technology in controlled laboratory environments, there are still concerns and challenges when collecting and using such information in real life and when trying to establish am identification system at a national level.

- *Not everyone can participate in a fingerprint-based identification system.* Fingerprints can be unrecognizable due to cuts or burns. In addition, older individuals may have fingerprints that have worn with edge, and the operation of fingerprint readers may be jeopardized due to arthritis. In some areas, especially those with past or present conflict, individuals may lack fingers altogether. In the most comprehensive study to test the process and customer attitude during the recording of biometric information, the United Kingdom passport service trial reports an enrollment success rate of 100 percent for the 9,250 nondisabled participants and 96 percent for the 750 disabled participants. In Malawi, only about 2 percent of the sample of 1,600 fingerprinted farmers had to have their left thumbprint recorded when the scanner failed to capture the required right thumbprint. This is surprising, as it turns out, because many Malawian farmers grow tobacco, which requires the heavy use of fingertips in the transplant of seedlings. Over the years, their fingerprint ridges may become too worn to be read or captured by a fingerprint scanner.
- *The accuracy of biometric technology remains, to a large extent, untested.* Biometric companies report very high accuracy rates from highly controlled trials that typically use artificially generated data. However, because the performance of a technology depends greatly on the context in which it is used, trials using real-life data are far less impressive. For example, the United Kingdom passport service trial reports that only 80 percent of the participants could be correctly verified by their fingerprints, and younger individuals were more successfully identified than older ones. In Malawi, however, everyone selected during demonstration sessions was correctly identified.
- *Individuals may have a negative attitude toward providing their biometrics.* People may be reluctant to place their fingers on scanners due to hygiene concerns. More importantly, there is the widespread public perception that fingerprinting is linked to the criminal justice process. Therefore, in conflict-affected countries that are stricken by ethnic infighting, individuals may refuse to provide biometrics for fear of persecution by authorities or others who could gain illegal access to such biometric records. The parliamentary debates concerning the United Kingdom's identification cards bill revealed that 55 percent of poll respondents thought the collection of biometric information was an infringement of civil

liberties. The authors did not encounter any such resistance from farmers in Malawi, perhaps because the technology was very novel.

- *The cost of collecting biometrics can be high.* The estimates are sparse, and detailed cost-benefits analyses have not been systematically conducted. However, the costs of using different types of biometric technology—from basic fingerprinting techniques to voice- and iris-recognition software—can be prohibitively expensive. In India there are legitimate concerns that the costs of rolling out biometric technology may mean a huge opportunity cost for over 700 million Indians living in poverty to receive social benefits. In the United Kingdom, a critical report by several researchers at the London School of Economics and Political Science found that the government underestimated the implementation of the Identity Cards Bill. The report suggests that the ten-year rollout would cost between 10.6 billion and 19.2 billion pounds sterling, excluding public- or private-sector integration costs.
- *Biometric technology is not infallible.* While using biometric identification systems can be a big step toward combating issues of identity theft, fraud, and money-laundering efforts, they are essentially technological applications. As is the case with any other technology, it can be hacked or infiltrated, so it runs the risk of having data fall into the wrong hands. Since biometric technology is only being piloted on a large scale in some pockets of the world at present, legitimate concerns on privacy do arise. For example, it is possible to imagine that identification-database workers will be threatened, blackmailed, and possibly corrupted. After all, the perpetrators of 80 percent of all computer security lapses are not hackers, but employees.
- *It is important that a common platform is used if biometrics data are merged with other datasets.* Biometric data are stored in formats that may not be compatible with the information systems of other government agencies, so an effort must be made to have compatibility if biometrics are to serve as the basis for a national identification system.

Conclusion

Despite these concerns, biometric technology presents an exciting and innovative opportunity for increased access to financial markets and better public service delivery. Whether it can be scaled up effectively and used to resolve identification and authentication issues is a challenge that requires more research.

For Further Reading:

X. Giné, J. Goldberg, and D. Yang, “Identification Strategy: A Field Experiment on Dynamic Incentives in Rural Credit Markets”, World Bank Policy Research Working Paper No. 5438. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1687508